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72 inventor: Gandiglio, Romolo  
Via Torino, 33  
I-14019 Villanova D'Asti(IT)

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71 Applicant: FIAT AUTO S.p.A.  
Corso Giovanni Agnelli 200

74 Representative: Cerbaro, Elena et al  
c/o Studio Torta, Via Viotti 9  
I-10121 Torino(IT)

54 Driving wheel unit for an electric traction vehicle.

57 A driving wheel unit suitable for an electric traction vehicle. The unit consists of a stub axle joined to a vehicle wheel suspension, a wheel hub mounted idle on the axle and capable of being fitted angularly and integrally with a wheel of the vehicle, a first enclosing element fixed angularly and integrally to the hub, peripherally projecting from it in a radial direction, at least one permanent magnet supported peripherally by the first enclosing element so as to define therewith a rotor of an electric motor, and a stator of an electric motor joined integrally with the stub axle and composed of at least one coil connectable to a source of electric power and of a second enclosing element coaxial with and facing the first and supporting peripherally said coil.

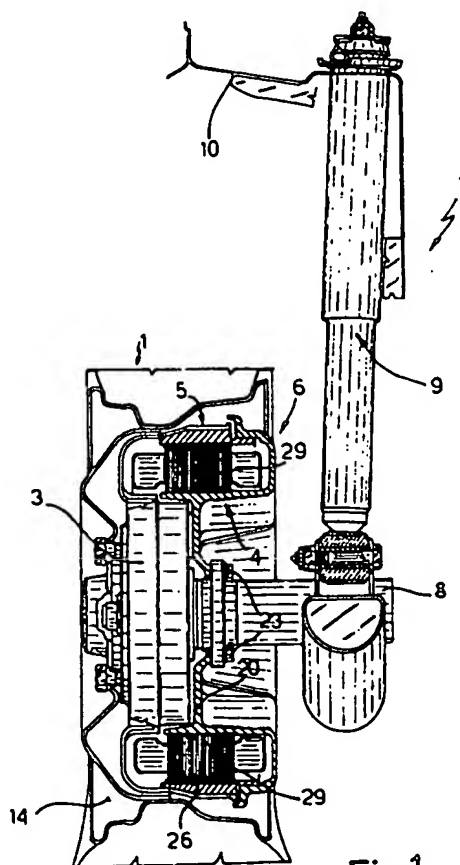


Fig.1

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The present invention refers to a driving wheel unit suitable for an electric traction vehicle.

For the propulsion of electric traction vehicles it is known to be advantageous to use, instead of a single motor attached by a mechanical transmission to the driving wheels, several motors mounted directly on the driving wheels. From European patent application number 0345123, for example, one technical solution is known in which all four wheels of a vehicle are each provided with a respective independent propulsion unit. Each unit is suspended from two swinging suspension arms in an articulated quadrilateral arrangement, and has an output shaft; the respective wheel of the vehicle is fitted directly to the output shaft.

The solution described in this European patent application is still not free from inconveniences: in particular, it requires the use of specially produced wheels and there are serious problems in accommodating and supporting the braking devices; finally it results in a relatively complex, heavy structure.

An aim of the invention is to produce a driving wheel unit for propelling an electric traction vehicle which has a simple and light structure, on which the wheels normally on sale for vehicles with endothermic engines currently in circulation can be mounted, and which is compact.

The abovementioned aim is achieved by the invention, which relates to a driving wheel unit suitable for an electric traction vehicle, of the type comprising a stub axle connected to a wheel suspension of the vehicle and a wheel hub mounted idle on the axle and capable of being fitted angularly and integrally with a vehicle wheel, characterised by the fact that it further comprises a first enclosing element fixed angularly and integrally to the hub and projecting peripherally from it in a radial direction, at least one permanent magnet supported by said first enclosing element in such a manner as to define therewith a rotor of an electric motor, and a stator of an electric motor joined integrally with the stub axle and comprising at least one coil connectable with a source of electric power and a second enclosing element coaxial with and facing the first and supporting peripherally said coil.

For a better understanding of the invention, a non-limitative description is now given of one embodiment thereof, with reference to the appended drawings, in which:

figure 1 illustrates a vehicle suspension fitted with a driving wheel unit produced according to the invention; and

figure 2 illustrates on an enlarged scale the driving wheel unit of figure 1.

With reference to figures 1 and 2, there is indicated as a whole by 1 a driving wheel unit

suitable for an electric traction vehicle otherwise known and not illustrated for simplicity, provided on board with a suitable electric power supply also of a known type and not illustrated for simplicity, for example batteries. The unit 1 comprises a stub axle 2 and a hub 3, both of a known type, on which, according to the invention, are fitted respectively a stator 4 and a rotor 5 of an electric motor 6, of a generally known type. The stub axle 2 is joined in a known manner to a suspension 7 of the vehicle, which in the non-limitative example illustrated is of the rigid axle type, and comprises an axle 8 which has stub axle 2 joined integrally to it, and a shock absorber 9 joined to the body 10 of the vehicle and to the axle 8. It is obvious that, according to a possible variant not illustrated, the wheel unit 1 can also be supported by an independent type wheel suspension, for example the "McPherson" type, by simply joining the stub axle 2 in a known manner directly to the suspension upright, in turn joined to a typical shock absorber 9.

The stub axle 2 supports the hub 3 idle in a known manner, for example by a roller bearing 11 fastened axially against a shoulder 12 of stub axle 2 by a nut 13. The hub 3 in turn supports, in a known manner, a wheel 14 of any known type commonly used on road vehicles. In particular, the wheel 14 is fixed by means of bolts 15 and a flange 16 to the hub 3, which is provided as part, and on the outside periphery, of a known brake drum 18. Integral with stub axle 2 is mounted a brake support bracket 20, which is positioned facing flange 16 of hub 3 and supports in a known manner respective known brake shoes 21 (only one of which is visible in figure 2) capable in use of entering into frictional contact with the drum 18 to brake the rotation of the wheel 14 with respect to the stub axle 2, and a known hydraulic control device 22 for the brake shoes 21, attachable in a known manner not illustrated for simplicity to the brake circuit of the vehicle. In the example, the bracket 20 is connected to the axle 8 by means of bolts 23. If the suspension 7 is substituted by an independent type wheel suspension, the bracket 20 is then connected to the suspension upright or is integral thereto.

According to the invention, the unit 1 further comprises a first enclosing element 25 of electric motor 6 fixed angularly and integrally to hub 3 projecting peripherally from it in a radial direction, at least one permanent magnet 26 (in the example several permanent magnets 26 arranged in a ring) supported peripherally by enclosing element 25 which, together with the magnet(s) 26, therefore defines the rotor 5, a second enclosing element 28 positioned coaxially with and facing element 25 and connected integrally with the stub axle 2, and at least one coil 29 of a known type (in the example

several coils 29 arranged in a ring) connectable in a known manner not illustrated for simplicity with the said electric power supply and supported integrally by element 28 which, together with the coil(s) 29, thus defines the stator 4.

Elements 25, 28 are both cup-shaped, positioned with the concavities facing each other, and each comprises a respective radially external front peripheral edge, indicated respectively by 31 and 32. These edges 31, 32 cooperate with each other without touching to define between elements 25, 28 which, in use are in relative rotation, a labyrinth seal to protect the motor 6.

In particular element 25 comprises a semi-toroidal element 33 of pressed sheet metal joined integrally to wheel hub 3 on brake drum 18, and an annular element 34 supporting the magnets 26 and positioned inside the semi-toroidal element 33 partially projecting outside it in an axial direction with a portion 35 thereof of smaller diameter joined to a lateral wall 36 radially external to semi-toroidal element 33. One end of the lateral wall 36 is provided radially outwards with a rim 40 which, together with projecting part 35 of element 34, separated from the rest of element 34 by an annular channel 41, delimits the said edge 31 of semi-enclosure 25, which thus has an overall shape conjugate with that of edge 32, which in radial section is substantially Z-shaped and faces rim 40 radially external thereto and to projecting portion 35 of element 34, thus creating a sinuous labyrinth seal between elements 25, 28.

Enclosing element 28 is in radial section substantially J-shaped in a position parallel with the wheel axle and, in the example, is obtained as part of brake support bracket 20 on the external periphery thereof. The stator 4 and rotor 5 are dimensioned with maximum external diameters which enable them to be housed entirely inside the wheel 14. Consequently, in use, the unit 1 can be fitted with a standard wheel and perform all the functions of a normal driving wheel unit, including that of braking the wheel 14, in the example by means of a braking device with a known drum already in general use. When current is supplied to the coil(s) 29, a rotating magnetic field is produced which acts on magnets 26 rotating the rotor 5 with respect to the stator 4. Motion is thus also transmitted to the hub 3 driving the wheel 14 without the need for mechanical transmission.

From what has been described, the advantages of the invention are evident. An integrated driving wheel unit of compact dimensions and great simplicity is obtained. It can be produced largely with standard components and is also fitted with braking devices. In particular, the cost of such a unit can be very low, since the electric motor 6 is integrated into the wheel unit simply by attaching to the

periphery of otherwise standard parts, such as hub 3 and brake support bracket 20, two semi-enclosures one of which supports the elements of the stator and the other those of the rotor.

## Claims

1. A driving wheel unit, suitable for an electric traction vehicle, of the type comprising a stub axle joined to a wheel suspension of the vehicle and a wheel hub mounted idle on the stub axle and capable of being fitted angularly and integrally with a vehicle wheel, characterised by the fact that it further comprises a first enclosing element fixed angularly and integrally to the hub and peripherally projecting from it in a radial direction, at least one permanent magnet supported peripherally by said first enclosing element in such a manner as to define thereby the rotor of an electric motor, and a stator of an electric motor connected integrally with the stub axle and comprising at least one coil connectable with a source of electric power, and a second enclosing element coaxial with and facing the first and supporting peripherally said coil.
2. A driving wheel unit according to claim 1, characterised by the fact that said first and second enclosing elements are both cup-shaped positioned with their concavities facing each other and each has a respective radially external front peripheral edge; said edges cooperate with each other to define, between said first and second enclosing elements, a labyrinth seal.
3. A driving wheel unit according to claim 2, characterised by the fact that said first enclosing element comprises a semi-toroidal element of pressed sheet metal joined integrally to said wheel hub, on a brake drum thereof, and an annular element supporting said permanent magnet and positioned inside the semi-toroidal element, with a portion thereof of smaller diameter partially projecting from it in an axial direction, joined to a lateral wall radially external to the semi-toroidal element; one end of said lateral wall of the latter, provided with a rim, and said projecting portion of smaller diameter of said annular element, separated from the rest of the element by an annular channel, defining said peripheral front edge of the said enclosing element.
4. A driving wheel unit according to claim 3, characterised by the fact that said second enclosing element is in radial section substan-

tially J-shaped in a position parallel with the wheel axle and is obtained as part, and on the external periphery, of a brake support bracket integral with the stub axle; said peripheral front edge of the second enclosing element being in radial section substantially Z-shaped and being positioned radially facing the exterior of said rim of the edge of the lateral wall of said semi-toroidal element and said projecting portion of smaller diameter of said annular element.

5. A driving wheel unit suitable for an electric traction vehicle, of the type comprising a wheel hub, a brake drum, means of braking capable of cooperating with the brake drum, and an electric motor comprising in turn a stator and a rotor, characterised by the fact that said stator supports said braking means directly and by the fact that said hub is comprised of the rotor of the electric motor, said rotor being obtained as part of the brake drum and supporting respective permanent magnets of the electric motor, while the respective coils of the electric motor are supported by the stator.

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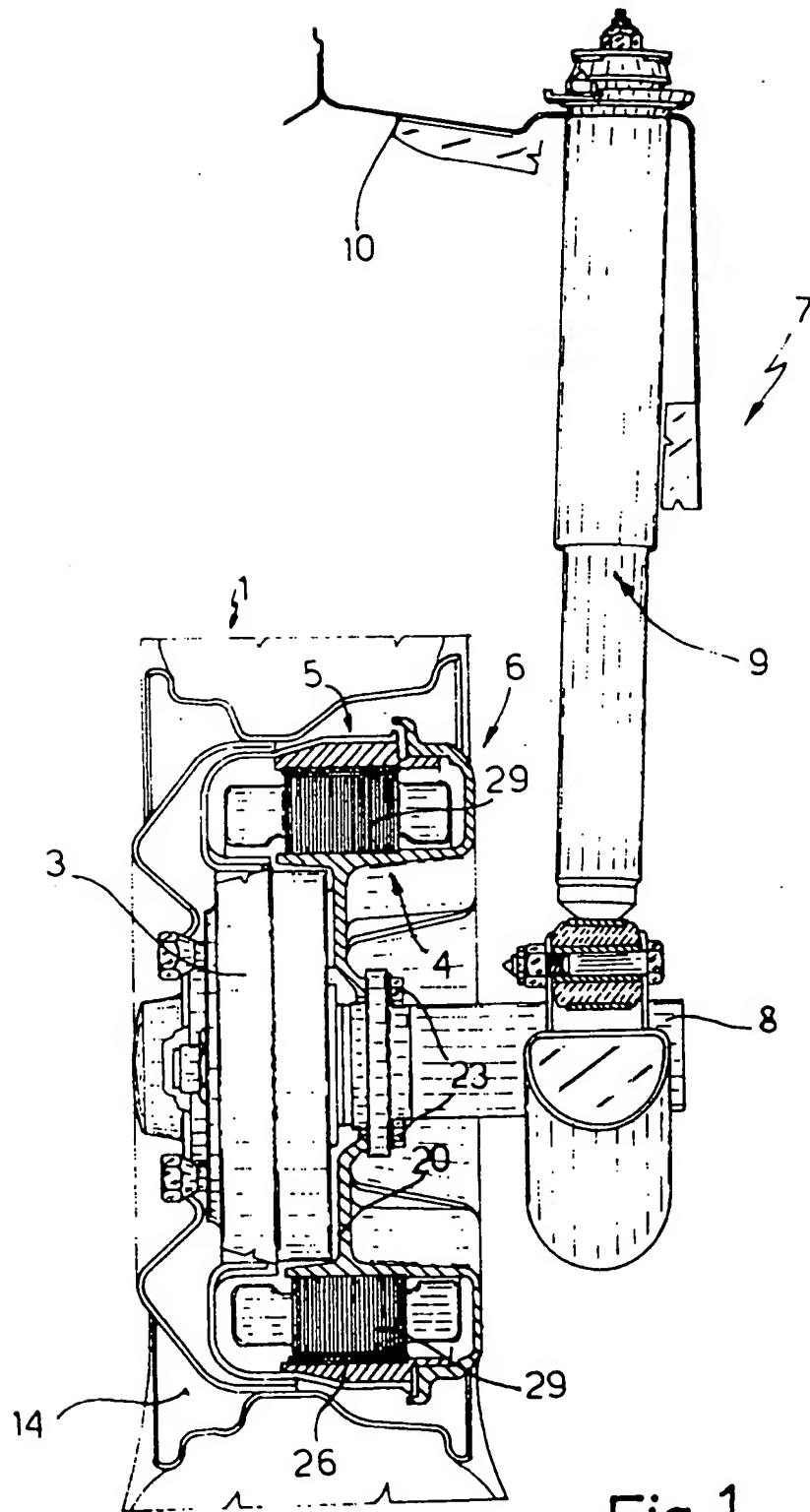
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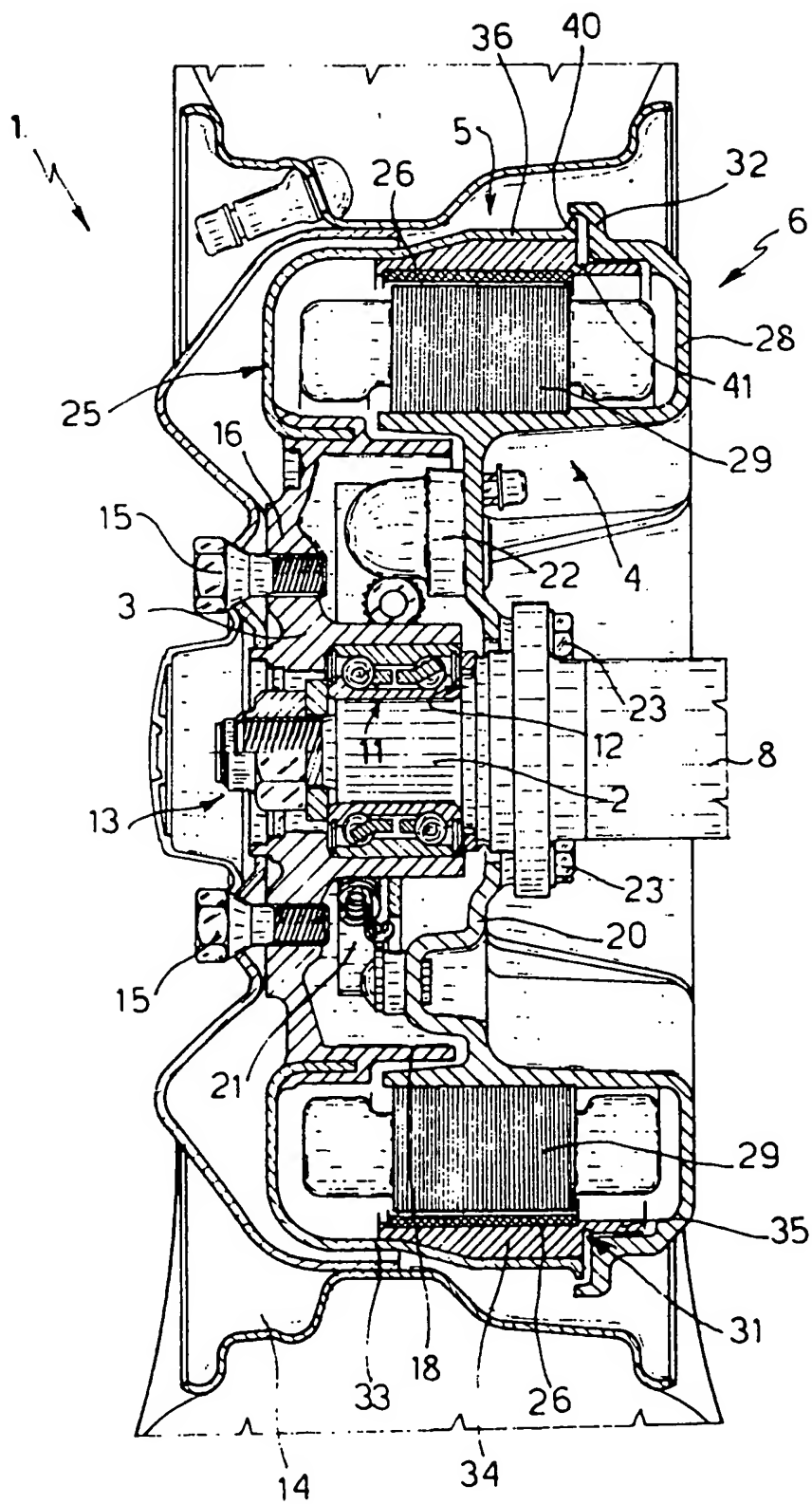


Fig.2



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## EUROPEAN SEARCH REPORT

Application Number

EP 91 12 1282

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-2 150 833 (W.A.HOCKETT) * the whole document *	1,5	B60K7/00
	* page 1, column 2, line 14 - line 17; figure 5 *	2	
A	---	3,4	
X	EP-A-0 337 032 (NIPPON STEEL CORP.)	1,5	
A	* abstract; figures 2-3,6,9 *	2	
	---		
Y	US-A-2 581 551 (G.M.MYRMIRIOES) * the whole document *	1,5	
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Y	FR-A-2 561 593 (BRUYANT) * the whole document *	1,5	
	---		
A	DE-C-201 263 (COELNER ELEKTROMOBIL WERKE HEINRICH SCHEELE) * the whole document *	1,5	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B60K B60L
Place of search THE HAGUE		Date of completion of the search 14 APRIL 1992	Examiner VINGERHOETS A.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons @ : member of the same patent family, corresponding document			

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